The Rivers of Greece
Evolution, Current Status and Perspectives
The Handbook of Environmental Chemistry

Founded by Otto Hutzinger

Editors-in-Chief: Damià Barceló • Andrey G. Kostianoy

Volume 59

Advisory Board:
Jacob de Boer, Philippe Garrigues, Ji-Dong Gu,
Kevin C. Jones, Thomas P. Knepper, Alice Newton,
Donald L. Sparks
Preface

Greece is a small mountainous country with a remarkably varied relief, complex geological structure, a rich palette of microclimates, and diverse aquatic ecosystems hosting particularly rich biodiversity.

There is an erroneous perception that Greece is a dry country. This perception is derived from the fact that large areas of East and South Eastern Greece, which are popular tourist destinations, face water scarcity. In reality, the Greek Peninsula contributes over the double of river runoff in the European Mediterranean Sea (16%) compared to the surface area of the country (7%). The country is characterised by numerous, diverse, and highly fragmented small to medium-sized mountainous rivers and streams, running through steep narrow valleys. Large lowland areas that are diffused within prevailing rift valleys are drained by medium and large perennial rivers, which frequently form extensive flood and deltaic plains. Semi-arid landscapes are marked by intermittent to episodic streams. When considering this highly variable landscape, the uniqueness and diversity of aquatic flora and fauna is not surprising.

Water is according to Thales of Miletus (c. 624 – c. 546 BC) the originating principle of nature. Ancient Greeks defied rivers and created myths which conceal real physical-geological events. Since the second millennium BC, hydraulic and land reclamation works were conducted for water supply and protection against droughts and floods. Nowadays, to address the challenges of the unevenly spatial and temporal distribution of water resources, water managers diverted rivers and constructed numerous dams. Thus, the vast majority of medium and large rivers of the country are fragmented. The main pressures affecting running waters in Greece are hydromorphological modifications, agro-industrial wastewaters, agrochemicals, malfunctioning wastewater treatment plants, and, locally, mining. These pressures and particularly their combination with drought and water scarcity, triggered by gradual diminishing river flows, threaten lotic and riparian ecosystems.

Despite the vital importance of river ecosystems to the Greek civilization since ancient times, a comprehensive knowledge on their natural characteristics and diversity or the extent to which they have been exploited and degraded is limited.
This book volume is designed to provide a fundamental knowledge on the running waters of Greece covering topics related to potamology, either through means of review chapters or specific case studies. The topics covered include geomymthology, biogeography, hydrology, hydrogeochemistry, hydrobiology, geomorphological, geological and biogeochemical processes, human pressures and ecological impacts, water management, both in the antiquity and today, and river restoration. This volume can be used as a basic or supplementary text in undergraduate and postgraduate courses or lectures in river ecology, river basin management, and conservation.

Acknowledgements

All chapters have been reviewed by the editors of this book volume and by a series of external reviewers which we are delighted to acknowledge here for their valuable help: Dr. Stefania Erba (IRSA-CNR, Italy), Dr. Nikolaos Nikolaidis (TUC), Dr. Niki Evelpidou (UOA, Greece), Dr. Angela Rouvalis (UOP, Greece), and Dr. Panagiotis Michalopoulos, Dr. Vasilis Kapsimalis, and Dr. Christos Anagnostou (HCMR, Greece). Finally, we would like to express our gratitude to Martha Papathanasiou (HCMR, Greece) for linguistic and grammar check of all contributions and to Dr. Andrea Schlitzerger (Springer DE) for her cooperation and support during the preparation of this volume.

Anavissos, Greece
Nikos Skoulikidis
Anavissos, Greece
Elias Dimitriou
Anavissos, Greece
Ioannis Karaouzas
Contents

Part I  Origin and Evolution of Greek Rivers

Ancient Greece and Water: Climatic Changes, Extreme Events, Water Management, and Rivers in Ancient Greece .................. 3
Ilias D. Mariolakos

Natural Processes Versus Human Impacts During the Last Century: A Case Study of the Aliakmon River Delta ......................... 31
Michael Stylias

Part II  Ecological, Hydrochemical and Hydrological Features of Greek Rivers

The Biogeographic Characteristics of the River Basins of Greece ...... 53
Stamatis Zogaris and Alcibiades N. Economou

The State and Origin of River Water Composition in Greece .......... 97
Nikos Skoulikidis

Long-Term Hydrologic Trends in the Main Greek Rivers: A Statistical Approach ................................................................. 129
Angeliki Mentzafoou, Elias Dimitriou, and Anastasios Papadopoulos

Part III  Environmental and Anthropogenic Effects in River Ecosystems of Greece

Agro-Industrial Wastewater Pollution in Greek River Ecosystems .... 169
Ioannis Karaouzas

Overview of the Pesticide Residues in Greek Rivers: Occurrence and Environmental Risk Assessment .............................. 205
Dimitra Lambropoulou, Dimitra Hela, Anastasia Koltsakidou, and Ioannis Konstantinou

Geochemical Processes of Trace Metals in Fresh–Saline Water Interfaces. The Cases of Louros and Acheloos Estuaries ............... 241
Michael Scoullos and Fotini Botsou

The Evrotas River Basin: 10 Years of Ecological Monitoring ........... 279
Ioannis Karaouzas, Christos Theodoropoulos, Leonidas Vardakas, Stamatis Zogaris, and Nikolaos Skoulikidis

Macroinvertebrate Assemblages and Biological Status of Rivers in Northern and Central Greece ........................................... 327
Lazaridou Maria and Ntislidou Chryssoula

Part IV  Water Management & Watershed Restoration in Greece

Phoebe Koundouri, Dimitrios Reppas, and Vassilis Skiannis

Environmental Impacts of Large-Scale Hydropower Projects and Applied Ecohdrology Solutions for Watershed Restoration: The Case of Nestos River, Northern Greece ......................... 379
Georgios Sylaios and Nikolaos Kamidis

River and Wetland Restoration in Greece: Lessons from Biodiversity Conservation Initiatives .............................................. 403
Stamatis Zogaris, Nikolaos Skoulikidis, and Elias Dimitriou

Index ..................................................................................... 433